HPCC Year Two Progress Report
"A Distributed, Real-time Hurricane Wind Analysis System"
Hurricane Research Division NOAA/AOML, Miami, FL

The following is a progress report for the second year of a three year project entitled "A Distributed, Real-time Hurricane Wind Analysis System". The second year of this project has been funded by NOAA's High Performance Computing and Communications Program, with Matching funds provided through the FEMA-NIBS HAZUS Project.

Updated* Milestones and Deliverables

1. **10-01-1999**
Completion of scripts for automated data transfer from space-, aircraft-, ocean-, and land-based observing systems using Local Data Manager (LDM).
2. **07-15-1999**
Prototype database schema design and evaluation versions of the database.
3. **11-01-1999**
Continue development of graphical, interactive, workstation/web version of analysis software (H*WIND). Provide software components to NHC for development of operational automated (non-interactive) version of analysis.
4. **12-01-1999**
Design of operratoinal, research and Emergency Management (EM) products.
5. **09-15-1999**
Evaluation of Java-based workstation/web (alpha) versions of analysis at NHC, AOML.

* The project commenced when the HPCC funds were received in February 1998.

Progress by Milestone

1. Completion of scripts for automated data transfer from space-, aircraft-, ocean-, and land-based observing systems using Local Data Manager (LDM).

Documentation:

As of July, 1999, the following data are available to the system via LDM and our decoders: CMAN stations, buoys, ships, METAR data, GPS drops, SFMR data from the NOAA P3, and Vortex messages. Most of the other data types that we need are already available through the LDM system, and decoders and scripts have been written for most them. We have also reused the hrd java packages to meet some of our decoding and adjustment needs, thereby minimizing bugs and testing time.

2. Prototype database schema design and evaluation versions of the database.

Documentation:

Work is complete on a database schema under an Oracle 8 Object Relational DBMS. The schema is based on the Masters Thesis* of the project's database administrator and database developer. We are currently using the database schema for preliminary testing and evaluation of the new wind analysis system.

*Morisseau-Leroy, N., Atmospheric Observations, Analyses, and The World Wide Web Using a Semantic Database, Master Thesis, School of Computer Sciences, Florida International University, Miami, FL, 1997

3. Continue development of graphical, interactive, workstation/web version of analysis software (H*WIND). Provide software components to NHC for development of operational automated (non-interactive) version of analysis.

Documentation:

Development for both the QCClient and Analysis Automation subsystems of the new system is ongoing and progressing steadily and is undergoing interactive Quality Assurance testing. In general, all code is up to date with latest JAVA Development Kit (jdk) release (java 2) and implementation of most functionality is complete including database integration.

Most of the client application sub project and analysis sub project functionality requirements have been met. Some of the requirements for the QCClient application include: 1) map loading and drawing, 2) plotting of wind observations and storm track fixes in both synoptic and storm relative coordinates, 3) graphical tools such as zooming, observation flagging (quality control), distance/heading calculation and detailed observation inspection and editing, 4) separate "views" panel for immediate graphical response to any changes to data, and 5) file import and export capabilities for legacy data files, landmarks files, and GIS files.

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The QCClient is part of the Masters Thesis** of the project's main application developer.

**Amat, Jr., L. R., *A Realtime Internet Based Quality Control Application for Hurricane Surface Wind Observations*, Master Thesis, School of Computer Sciences, Florida International University, Miami, FL, 1998.

4. Design of forecast, research, and Emergency Management (EM) products.

Documentation:

The PI and members of the H*WIND development team attended the HAZUS Users Workshop conducted in April, 1999 in Miami Beach (representative users from the emergency management, local government, and utilities discussed features required from the HAZUS wind module to serve as a disaster mitigation and planning tool). Based on feedback fromthe workshop, we have started work on creating GIS readable file versions of HRD's products. We currently have ways to read and create arbitrary "shapefiles" (an Arc View file format) in C and C++ as well as ways to read and display shapefiles in JAVA. Our work on shapefile generation is not complete, but we should have working tools by mid 2000. Many freely available tools exist for manipulating, viewing and translating shapefiles, so a user may use such a tool to create a file readable by another GIS, for example.

We have discussed ways to create an automated version of the wind analysis. Originally the NHC PI (Dr. Mark DeMaria) had intended to develop an automated analysis using parts of our legacy code and data processing routines. He has since changed employment and is working on generating satellite derived wind fields at the NOAA Cooperative Institute with Colorado State University. Since we need to maintain direct interaction with NHC, Dr. Edward Rappaport, chief of the Technical Support Branch (http://www.nhc.noaa.gov/abouttsb.html) of the Tropical Prediction Center / NHC, will replace Dr. DeMaria as the NHC PI on this project. NHC does not presently have the programming staff required to develop and maintain an automated version of the wind analysis system. We will focus on completing the workstation/web version of the system and will postpone development of an automated system to a later time.

Work on product generation routines will be completed in concert with the demand for new products. We have completed development on the subset of routines that represents the products that HRD had available in realtime in previous years. All the routines are now implemented in Research System Inc.'s (RSI) Interactive Data Language (IDL). The routines are capable of plotting images to a local screen and/or generating images in a variety of file formats for delivery as hard copies. We are investigating different methods of delivering dynamically generated IDL products over the web. Both CGI and Java based methods are possible, but software licensing, product delivery speed and the intricacy of the code are still issues to be resolved for each proposed method.

5. Evaluation Workstation/Web (interactive) versions of analysis at NHC, AOML

Documentation:

This milestone combines a great deal of work contained within other milestones, and , therefore requires that most of those milestones be met. As of late July, the Oracle database software for our NHC server has been entered into the AOML procurement system. Our ability to evaluate the Java version of

H*WIND will depend on how long it takes to deliver, install, integrate, and test the Oracle 8i software. As it stands now, our goal is to test the interactive version of the H*WIND system by mid September during the 1999 Atlantic hurricane season. In the meantime, we will continue to use the old (NEXTSTEP) version of the software to conduct Hurricane wind analyses from AOML or NHC, making use of our updated LDM scripts to deliver observations from a variety of wind measuring platforms in real time. Over 140 real-time wind analyses were conducted for the Atlantic basin during the very busy 1998 hurricane season. HRD scientists worked shifts to conduct analyses at 3-6 h intervals during landfall situations. Many of these analyses were conducted at NHC where we were able to interact with NHC forecasters while providing valuable guidance and gaining important feedback on how to improve our products.

Staff Changes

Luis Amat took a position with Oracle in July, 1999. He has offered to remain available for consultation on minor problems associated with the project at no charge. We are grateful for all the effort Luis put into leading the development of H*WIND as our main software engineer. The experience gained working on this project enabled him to obtain a very lucrative position outside government. Sonia Otero (a masters student in computer science at Florida International University) and Nicholas Carrasco (a Computer engineering student at University of Miami) will replace Luis. Both have been involved in the project on a part-time basis for 2 years and will now work a flexible full time schedule while continuing their studies.

Staff

Peer-Reviewed, Professional Scientific Publications

Powell, M. D., S. H. Houston, L. R. Amat, and N. Morisseau-Leroy, 1998: The HRD real-time hurricane wind analysis system. J. Wind Engineering and Indust. Aerodynamics, 77&78, 53-64

Books
Nirva's book (in preparation)

Masters Theses
Luis, Nirva, Sonia (proposal)

Conference Papers and Presentations
Add Nirva's conference presentations at IIPS, Java and Oracle conferences include photo

NCAR Colloquium

Powell, M. D., and E. Rappaport, Panel Discussion on Surface Winds in Hurricanes. Annual Meeting of the American Meteorological Society, Dallas, TX, Jan 12, 1999.

Amat Jr., L.R., *A Realtime Internet Based Application for the Archival, Quality Control and Analysis of Hurricane Surface Wind Observations*, Preprint Volume, 15th International Conference On Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology, January 10-15, 1999, Dallas, TX. Session 17, Data and Information Handling, Paper and Oral Presentation.

Amat Jr., L.R., *A Realtime Internet Based Quality Control Application for Hurricane Surface Winds*, Master Thesis, School of Computer Sciences, Florida International University, Miami, FL, 1998.

Amat Jr., L.R., Powell, M.D., Houston, S.H., *WANDA: HRD's Real-time Tropical Cyclone 'Wind Analysis Distributed Application'*, Preprint Volume, 14th International Conference On Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology, January 11-16, 1998, Phoenix, AZ. Session J5, Joint Session with 16th Conference on Weather Analysis and Forecasting, Paper and Oral Presentation

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